HK 39: Invited Talks 3

Time: Wednesday 11:00–13:00 Location: T/HS1

Invited Talk HK 39.1 Wed 11:00 T/HS1

Precision Tests of CPT Invariance with Single Trapped Antiprotons — •Stefan Ulmer for the BASE-Collaboration — RIKEN, Ulmer Initiative Research Unit, Wako, Saitama, Japan

The reason for the striking imbalance of matter and antimatter in our Universe has yet to be understood. This is the motivation and inspiration to conduct high precision experiments comparing the fundamental properties of matter and antimatter equivalents at lowest energies and with greatest precision. According to theory, the most sensitive tests of CPT invariance are measurements of antihydrogen ground-state hyperfine splitting as well as comparisons of proton and antiproton magnetic moments. Within the BASE collaboration we target the latter. By using a double Penning trap we performed very recently the first direct high precision measurement of the proton magnetic moment. The achieved fractional precision of 3.3 ppb improves the currently accepted literature value by a factor of 2.5. Application of the method to a single trapped antiproton will improve precision of the particles magnetic moment by more than a factor of 1000, thus providing one of the most stringent tests of CPT invariance. In my talk I will report on the status and future perspectives of our efforts.

Invited Talk HK 39.2 Wed 11:40 T/HS1

Recent results on the proton: Two photon exchange and the radius puzzle — •Jan Bernauer — Massachusetts Institute of Technology, Cambridge, USA

The proton form factors and radii are in the limelight of recent and ongoing experimental and theoretical efforts, mainly driven by two anomalies. On the one hand, precise determinations of the form factor ratio with experiments using polarization differ from Rosenbluth-type extractions. The discrepancy is attributed to two-photon exchange contributions to the scattering process. Three modern experiments, at VEPP-3, Jefferson Lab and DESY (OLYMPUS), aim to measure this effect directly. On the other hand, a measurement of the Lamb shift in muonic hydrogen atoms gives a result 10 times more precise, but 7 sigma smaller than determinations from elastic scattering and electronic hydrogen spectroscopy. So far, this discrepancy is not understood. In the talk, I will present the latest results and the state of research on both fronts.

Invited Talk HK 39.3 Wed 12:20 T/HS1

Precision Experiments with Slowed-down and Thermalized Projectile and Fission Fragments — •Wolfgang Plass — II. Physikalisches Institut, Justus-Liebig-Universität Gießen — GSI Helmholtzzentrum für Schwerionenforschung GmbH

Novel precision experiments with exotic nuclei will be enabled using the combination of the in-flight separation method with modern techniques for efficiently slowing-down, thermalizing and manipulating projectile and fission fragments produced at relativistic energies. Two key devices for this approach have been developed for the Low Energy Branch of the Super-FRS at FAIR: A cryogenic stopping cell and a multiple-reflection time-of-flight mass spectrometer. They have recently been commissioned as part of the FRS Ion Catcher experiment at GSI and first measurements have been performed. The reach to rare (few ions per hour) and very short-lived (half-lives of a few milliseconds) nuclides produced at the FRS at 1000 MeV/u has been demonstrated. The potential of the mass spectrometer as a versatile and efficient tool for the study of isomers and the production of isobarically and isomerically pure beams has been shown. Envisaged applications include the direct mass measurements of very rare nuclides and the decay spectroscopy of pure ion samples. In addition, application of these developments in analytical mass spectrometry opens up completely new possibilities for in-situ studies e.g. in climate or environmental research, medicine and safety.